Chemical Composition and Dynamics of the Upper Troposphere and the Lower Stratosphere

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Dynamical, chemical and radiative coupling between the stratosphere and troposphere are among the important processes that must be understood for prediction of global trends, including climate change. The upper troposphere and lower stratosphere (UTLS) is an important region for Earth's climate because water vapour, ozone, cirrus clouds, and aerosols in this region strongly contribute to radiative forcing of the climate system. We propose multifaceted analyses of the UTLS region, based on new satellite data and modern chemistry-transport/chemistry-climate models. Special scientific focuses of the proposed project are: (i) dynamical and chemical structures of the extra-tropical UTLS and tropical tropopause layer (ii) disturbance of dynamics and chemistry in the UTLS region by multiscale processes (iii) stratosphere-troposphere exchange of chemical compositions (iv) stratospheric ozone variability and updated ozone climatology. In this project, the quality of satellite data in UTLS will be thoroughly assessed, with potential improvement of retrievals in UTLS or/and developed algorithms for optimal data screening. The project relies strongly on using the data from GOMOS and MIPAS instruments on board the Envisat satellite, OSIRIS on board Odin, ACE-FTS and MAESTRO on board SCISAT-1, as well as other available data in this altitude region. A recent Chinese SBUS (Solar Backscatter Ultraviolet Sounder) on board FY-3B, the second satellite of Chinese new generation polar orbit meteorological satellite FY-3 series, will also be applied in this project.

This research is a joint project between Finnish Meteorological Institute (FMI) and Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences. It is also a continuity of the previous collaborations built within the framework of Dragon I and II projects. Work by both teams will be part of the normal scientific research. FMI's work will be partly covered by the on-going project supported by the Academy of Finland. The FMI team will apply for additional funding from the Academy of Finland. The IAPs work will be partly supported by the on-going project funded by the National Natural Science Foundation of China and the Ministry of Science and Technology of China. The IAP team will also apply for additional funding from Chinese Academy of Sciences and China Meteorological Administration to launch ozone sondes and perform ground-based measurements in China.

上对流层-下平流层中的大气化学成分与动力过程研究

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大气平流层与对流层在动力、化学、辐射方面的耦合对于理解和预测全球气候变化趋势具有重要意义。在上对流层-下平流层（Upper Troposphere and Lower Stratosphere, UTLS）区域，水汽、臭氧、卷云以及气溶胶等强烈地影响着气候系统的辐射强迫，因此关于该区域的研究对于全面认识整个地球气候系统至关重要。本研究将基于最新的卫星资料、大气化学输送模式以及化学-气候模式，对UTLS区域进行多方面的分析。具体的研究内容主要包括：（1）热带外UTLS以及热带对流层顶区域的动力、化学结构；（2）多尺度过程所导致的UTLS区域动力、化学扰动；（3）大气化学成分的平-对流层交换；（4）平流层臭氧的变率及其气候态。本研究还将对卫星资料在UTLS区域内的质量进行评估，并争取对UTLS区域卫星观测的反演算法进行一定的改进。计划使用的卫星资料主要包括：ENVISAT卫星上的GOMOS、MIPAS观测资料、Odin卫星上的OSIRIS观测资料、SCISAT-1卫星上的ACE-FTS、MAESTRO观测资料以及能够获取的其他卫星资料。同时，中国最近成功发射的FY-3B是中国新一代极轨卫星风云三号系列的第二颗星,该卫星携带了紫外臭氧垂直探测仪SBUS(Solar Backscatter Ultraviolet Sounder)，本研究也将对该仪器得到的臭氧观测资料进行初步的评估和应用。

本研究是芬兰气象研究所与中国科学院大气物理研究所、国家卫星气象中心之间的合作项目，它进一步深化了中-芬双方基于"龙计划"一、二期所建立的合作研究关系。本项目的研究目标是双方日常研究工作的一部分。目前，芬方的研究工作主要得到了芬兰科学院在研项目的资助，并计划向芬兰科学院申请进一步的经费支持。中方的研究工作主要得到了国家自然科学基金委员会以及中国科技部在研项目的大力资助；同时，为了加强对中国境内大气臭氧的探空和地基观测研究，中方也计划向中国科学院与中国气象局申请相关研究经费。